

Bernier describes the use of a laser to accomplish selective electroless copper plating, or laser direct-writing of metal, thereby reducing or eliminating the need for masking. *See* Bernier, Introduction. Therefore, the proposed combination of Bernier with either Tan or Farnworth teaches away from the present invention because one of ordinary skill in the art would be lead away from using photoresist layers and plasma ashing as is recited , in part, in claim 7.

No motivation to combine Dubin with Tan or Farnworth:

The mere fact that the prior art could be modified to provide the claimed invention is not sufficient to establish obviousness, there must be motivation (e.g., a teaching, suggestion, or incentive) in the prior art to make such modification to make the invention. MPEP § 2143.01.

Claim 7 recites, among other things, depositing a patterned photoresist layer over the seed layer, wherein depositing the patterned photoresist layer defines a number of via holes opening to the seed layer, and depositing a layer of copper over the seed layer using electroless plating. Applicant is unable to find a teaching, suggestion or incentive within the proposed combination of references to place a photoresist layer over a seed layer and use electroless plating to form vias.

The Office Action states the motivation is to obtain a simpler and less costly process and that this motivation is provided in Dubin. *See* page 4 of the Office Action. However, this is not a teaching, suggestion, or incentive to combine electroless plating with use of a photoresist layer to form vias. Therefore, the Office Action appears to be using impermissible hindsight from the present application to provide the motivation. MPEP § 2143.

Applicant traverses the Official Notice:

Claim 7 recites, among other things, depositing a patterned photoresist layer over the seed layer, ... depositing a layer of copper over the seed layer using electroless plating, and removing the photoresist layer using oxygen plasma ashing.

The Office Action took official notice of the element “removing the photoresist layer using oxygen plasma ashing” in the claim. Applicant respectfully traverses this official notice and requests the Examiner to provide a reference that describes such an element used with electroless plating. Absent a reference, it appears that the Office Action relies on personal knowledge of the Examiner, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

The Office Action took official notice of the element “electroless plating discontinuous seed layer is used”. This does not exactly correspond to any feature in claim 7. Applicant respectfully traverses this official notice and requests the Examiner to provide a reference that describes such an element. Absent a reference, it appears that the Office Action relies on personal knowledge of the Examiner, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2).

Applicant respectfully requests reconsideration and allowance of claim 7.

Concerning claims 3, 5 and 65:

Applicant respectfully traverses the rejection. Claims 3, 5 and 65 depend on claim 7 and are believed to be allowable at least for the reasons stated above for claim 7.

The Office Action fails to provide a motivation to combine Farnworth and Tan as in the rejection of claim 3. Moreover, the Office Action is unclear as to how Farnworth and Tan are used to reject claim 3 as the statement that Farnworth [sic] fails to disclose this feature, but it is well known in the art. It appears that the examiner is taking Official Notice of something he considers well known in the art. Applicant is unclear what this feature is. Applicant is forced to traverse this statement that something is well known to clearly preserve issues for appeal. Applicant respectfully traverses this official notice and requests the Examiner to provide a reference that describes such a feature. Absent a reference, it appears that the Office Action relies on personal knowledge of the Examiner, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2). Allowance of claim 3 is requested.

Additionally, the Office Action states that depositing a layer of copper using electroless plating includes filling the number of via holes to a top surface of the photoresist layer, as recited in claim 5, is disclosed in Fig. 3 of Tan. *See* Office Action page 4. However, Fig. 3 of Tan shows the copper filled to a level below the top surface. Accordingly, Tan does not teach or suggest forming vias using electroless plating of copper. Allowance of claim 5 is requested.

Also, claim 65 recites, among other things, forming a discontinuous seed layer having island structures. Applicant is unable to find a description of a discontinuous seed layer having island structures in the Tan, Farnworth, Dubin or Bernier.

Applicant requests reconsideration and allowance of claims 3, 5 and 65.

Concerning claim 8:

Applicant respectfully traverses the rejection. As discussed above for claim 7, the Office Action fails to establish proper *prima facie* obviousness because the combination of Bernier with Tan or Farnworth teaches away from the present application and because the combination of Dubin with Tan or Farnworth lacks a motivation to make such modification as to produce the invention of the present application.

Additionally, Applicant is unable to find in the applied references a description of “depositing a seed layer including a thin film ... having a discontinuous island structure” recited, among other things, in claim 8. Applicant believes such a layer is lacking in the proposed combinations.

Applicant respectfully requests reconsideration and allowance of claim 8.

Concerning claims 9-12:

Applicant respectfully traverses the rejection. Claims 9-12 ultimately depend on claim 8 and are believed to be allowable at least for the reasons stated above for claim 8.

Also, concerning claim 9, the Office Action stated that any variation in thickness is obvious in light of the cited art because the changes in thickness produce no unexpected function. However, on page 18 lines 9-17 of the specification it is stated that the thickness of the layer does provide the unexpected function of allowing the seed layers to be removed along with the photoresist.

Further, Applicant is unable to find in the cited portions of the proposed combinations, filling the number of via holes to a top surface of the patterned photoresist layer recited in claim 11, or removing the photoresist layer using oxygen plasma ashing as recited in claim 12.

Applicant respectfully requests reconsideration and allowance of claims 9-12.

Claims 13-27 and 34-37 were rejected under 35 USC § 103(a) as being unpatentable Tan et al. or Farnworth et al. in view of Bernier et al. or Dubin et al. and Simpson (U.S. Patent No. 6,197,688).

Concerning claim 13:

Applicant respectfully traverses the rejection. As discussed above for claim 7, the Office Action fails to establish proper *prima facie* obviousness because the combination of Bernier with Tan or Farnworth teaches away from the present application. Applicant submits that because Bernier deals with laser-direct writing of metal, the addition of Simpson fails to cure the defect.

Applicant also believes the Office Action fails to establish proper *prima facie* obviousness because the combination of Dubin with Tan or Farnworth lacks a motivation to make such modification as to produce the invention of the present application. Applicant is unable to find a teaching, suggestion or incentive within the proposed combination of references to place a photoresist layer over a seed layer and to use electroless plating to form vias or filling conductor line openings. Applicant further believes the addition of Simpson fails to cure the defect of the combinations because Simpson teaches away from using electroless plating to form vias or conductor line openings. Simpson states that electroless plating is insufficient to fill interconnect openings. *See* Simpson, column 3 lines 16-22.

Further, the proposed combinations fail to describe all of the elements of claim 13. For example Applicant is unable to find in the cited portions of the references,

depositing a first seed layer ... on a substrate, depositing a first patterned photoresist layer, ... , forming the first layer of copper vias using electroless plating ... , depositing a second seed layer ... on the first layer of copper vias and the top surface of the photoresist layer, depositing a second patterned photoresist layer, and forming a second layer of copper using electroless plating, ... includ[ing] filling the second number of ... openings ... using electroless plating,

recited , among other things, in claim 13.

The Office Action also stated that the combined teaching of Tan or Farnworth and Bernier or Dubin does not disclose expressly the repetition of the steps in the forming of the vias to form conductive lines. The Office Action then cited *Ex Parte Rubin* to argue that the transposition of process steps or the splitting of the process steps into two, where the processes are substantially identical or equivalent in terms of function, manner and result was held to not patentably distinguish the processes. *See* Office Action page 5.

Applicant respectfully submits that because of the defects in forming the combinations of Tan or Farnworth and Bernier or Dubin and because the combinations do not disclose all of the

elements of claim 13, that claim 13 is not a mere transposition of process steps described in the references.

Applicant requests reconsideration and allowance of claim 13.

Concerning claims 14-19:

Claims 14-19 depend on claim 13 and are believed to be allowable at least for the reasons stated above for claim 13. Applicant respectfully requests reconsideration and allowance of claims 14-19.

Concerning claims 20 and 34:

Applicant respectfully traverses the rejection. As discussed previously for claim 13, the Office Action fails to establish proper *prima facie* obviousness because the combination of Bernier with Tan or Farnworth in further view of Simpson teaches away from the present application and because the combination of Dubin with Tan or Farnworth in further view of Simpson lacks a motivation to make such modification as to produce the invention of the present application.

Further, Applicant is unable to find in the cited portions of the references
depositing a first seed layer on a substrate, ... , forming a first level of copper vias
in the first number of via holes using electroless plating, depositing a second seed
layer ... on the first level of copper vias and first photoresist layer, ... , and
forming a first level of conductor lines in the second number of conductor line
openings using electroless plating,

recited, among other things, in claims 20 and 34. Applicant is unable to find such a combination of first seed layers, via layers, second seed layers and conductor lines in the proposed combination of references.

Applicant respectfully requests reconsideration and allowance of claims 20 and 34.

Concerning claims 21-27 and 35-37:

Claims 21-27 ultimately depend on claim 20 and claims 35-37 ultimately depend on claim 34. Claims 21-27 and 35-37 are believed to be allowable at least for the reasons stated above for claims 20 and 34.

Applicant respectfully requests reconsideration and allowance of claims 21-27 and 35-37.

Claims 28-33 and 38-42 were rejected under 35 USC § 103(a) as being unpatentable Tan et al. or Farnworth et al. in view of Bernier et al. or Dubin et al., Simpson, and Tomita et al. (U.S. Patent No. 5,034,799).

Concerning claims 28:

Applicant respectfully traverses the rejection. As discussed previously for claim 13, the Office Action fails to establish proper *prima facie* obviousness because the combination of Bernier with Simpson and Tan or Farnworth teaches away from the present application and because the combination of Dubin with Simpson and Tan or Farnworth lacks a motivation to make such modification as to produce the invention of the present application.

Specifically, Applicant believes methods that use the above combinations of photoresist, seed layers, and electroless plating to build the multi-layer structures described in the present application are not obvious in view of the combinations of references. Applicant believes the addition of Tomita does not cure the defects of the proposed combinations because Tomita does not contain a teaching, suggestion or incentive to use seed layers or electroless plating.

Applicant respectfully requests reconsideration and allowance of claim 28.

Concerning claims 29-33 and claims 38-42:

Applicant respectfully traverses the rejection. Claims 29-33 ultimately depend on claim 28 and claims 38-42 ultimately depend on claim 34. Applicant believes the claims are allowable at least for the reasons stated previously for claims 28 and 34.

Also, concerning claims 30 and 38, the Office Action stated that although the combined teaching of Tan or Farnworth, Bernier or Dubin, Simpson and Tomita does not disclose expressly where the removal of the photoresist layers includes the removal of the first, second and third seed layers, that it would have been obvious to a person ordinary skill in the art to do so since the portions of seed layers not connecting a via and a wiring line are not needed for the operation of the multi-level interconnect. *See* Office Action page 8.

By asserting that the element of the claims is obvious without using a reference, the Office Action appears to be taking official notice of the element. Applicant respectfully traverses the assertion of Official Notice and requests that the Examiner cite references in support of this position.

Applicant requests reconsideration and allowance of claims 29-33 and 38-42.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743

Respectfully submitted,

KIE Y. AHN ET AL.

By their Representatives,

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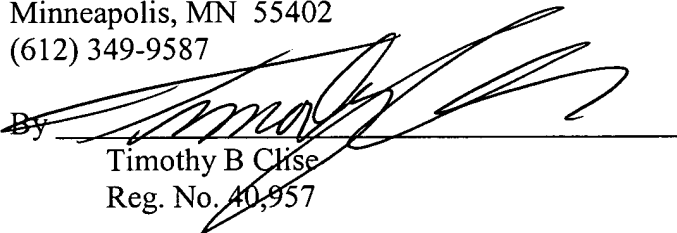
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24 Oct 2003

By



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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 24 day of October, 2003.

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